

## **Claims**

The claims are listed as follows:

1. (Original) A method of controlling data transmission in an Ethernet passive optical network (EPON) using a multi-point control protocol (MPCP), the method comprising:
  - (a) generating transmission permission messages using a bandwidth allocation mode and determining a transmission time duration of upstream data corresponding to the transmission permission messages;
  - (b) queuing the transmission permission messages according to types of the transmission permission messages;
  - (c) determining priorities of the transmission permission messages based on the types of the transmission permission messages and registration information of an optical network unit (ONU) that receives the transmission permission messages; and
  - (d) determining a transmission start time of upstream data based on a priority and outputting the transmission permission messages.
2. (Original) The method of claim 1, wherein the step (a) comprises:
  - (a1) when allocating a static bandwidth, generating first transmission permission messages, which contain a period and a transmission time duration according to a characteristic of the upstream data;
  - (a2) when allocating a dynamic bandwidth, generating second transmission permission messages, which include the allocated bandwidth information; and
  - (a3) generating third transmission permission messages to allocate bandwidth for MPCP control messages.
3. (Original) The method of claim 2, wherein in the step (a1), the first transmission permission messages are generated in descending order of a round trip time (RTT) of the ONU.
4. (Original) The method of claim 2, wherein the step (a) further comprises (a4) selecting one of static bandwidth allocation and dynamic bandwidth allocation and both static bandwidth allocation and dynamic bandwidth allocation.

5. (Original) The method of claim 4, wherein the step (a) further comprises (a5) generating fourth transmission permission messages, which are activated when allocating the dynamic bandwidth, to allocate bandwidth for transmitting a bandwidth request of the ONU while in a transmission silent state.
6. (Original) The method of claim 5, wherein the fourth transmission permission messages are generated in descending order of an RTT of the ONU which receives the fourth transmission permission messages.
7. (Previously Presented) The method of claim 5, further comprising (e) generating fifth transmission permission messages to automatically register a newly entered ONU in a network.
8. (Previously Presented) The method of claim 7, wherein the step (c) comprises (c1) designating a priority between the first through fifth transmission permission messages and outputting a message of a queue having a next priority only when a queue having a current priority is empty.
9. (Previously Presented) The method of claim 2, wherein the step (d) comprises (d1) determining the transmission start time using a value obtained by subtracting an RTT of the ONU from an estimated time when the upstream data is to be received.
10. (Original) The method of claim 9, wherein the step (d1) comprises:
  - (d11) recording a point in time corresponding to an end of upstream data transmission of the ONU using the first and second transmission permission messages; and
  - (d12) determining the transmission start time based on an estimated end time and a time counter of an optical line termination (OLT).
11. (Original) The method of claim 10, wherein in the step (d12), it is assumed that a transmission end time of the upstream data, which uses the latest permission, is  $E_{sub.s}$ , a current time counter is  $T_{sub.c}$  and a transmission time duration of the upstream data is  $T_{sub.dur}$ , if a value obtained by adding  $T_{sub.c}$  to the RTT is greater than  $E_{sub.s}$ , a value

obtained by subtracting the RTT from E.sub.s is determined as a transmission start time, and a value obtained by adding T.sub.dur to E.sub.s is updated as new E.sub.s, if the value obtained by adding T.sub.c to the RTT is less than or equal to E.sub.s, T.sub.c is determined as the transmission start time, and a value obtained by adding the RTT and T.sub.dur to T.sub.c is updated as a new E.sub.s.

12. (Previously Presented) An apparatus which controls data transmission in an Ethernet passive optical network (EPON) using a multi-point control protocol (MPCP), the apparatus comprising:

- a bandwidth allocation unit, which generates transmission permission messages to allocate upstream data transmission bandwidth to each optical network unit (ONU);

- a queuing unit, which queues the transmission permission messages according to types of the transmission permission messages;

- a scheduler, which determines priorities of the transmission permission messages from queues based on registration information of each optical network unit (ONU) that receives the transmission permission messages, determines a transmission start time of upstream data based on a priority, and outputs the transmission permission messages; and

- a control unit, which selectively designates static bandwidth allocation and dynamic bandwidth allocation.

13. (Original) The apparatus of claim 12, wherein the bandwidth allocation unit comprises:

- a static bandwidth generation portion, which generates first transmission permission messages that are activated when allocating a static bandwidth, which contain a period and a transmission time duration according to a characteristic of the upstream data in descending order of a round trip time (RTT) of the ONU that receives the first transmission permission messages;

- a dynamic bandwidth generation portion, which generates second transmission permission messages that are activated when allocating dynamic bandwidth and include the allocated bandwidth information;

- a control message generation portion, which generates third transmission permission messages to allocate bandwidth for MPCP control messages;

a minimum bandwidth generation portion, which generates fourth transmission permission messages that are activated when allocating the dynamic bandwidth and allocate bandwidth for transmitting a bandwidth request of the ONU, while in a transmission silent state, in descending order of the RTT of the ONU that receives the fourth transmission permission messages; and

a registration message generation portion, which generates fifth transmission permission messages to assign a transmission permission time for registration of a newly entered ONU in the EPON.

14. (Original) The apparatus of claim 12, wherein the scheduler comprises:

a time counter, which records an operating time of an optical line termination (OLT);  
a register, which records a transmission scheduling end time of the upstream data; and  
a calculation portion, which determines a transmission start time based on outputs of the time counter and the register.

15. (Previously Presented) The apparatus of claim 13, wherein the control unit determines activation of operations in the static bandwidth generation portion, the dynamic bandwidth generation portion, and the minimum bandwidth generation portion according to a property of the upstream data.

16. (Previously Presented) A computer readable recording medium on which a program is recorded, the program used for executing the method of controlling data transmission in an Ethernet passive optical network (EPON) using a multi-point control protocol (MPCP), wherein the method comprises:

(a) generating transmission permission messages using a bandwidth allocation mode and determining a transmission time duration of upstream data corresponding to the transmission permission messages;

(b) queuing the transmission permission messages according to types of the transmission permission messages;

(c) determining priorities of the transmission permission messages based on the types of the transmission permission messages and registration information of an optical network unit (ONU) that receives the transmission permission messages; and

(d) determining a transmission start time of upstream data based on a priority and outputting the transmission permission messages.